Human evolution and migrations

Human evolution: bush or basketwork? (*January 2014*)

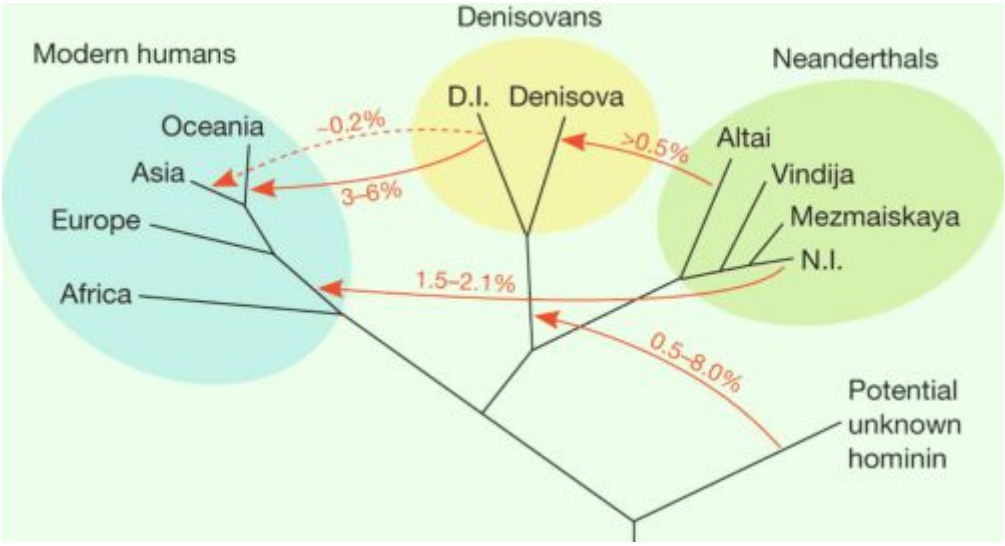
Analysis of DNA from ancient humans has revealed its power decisively in the last few years, and especially at the beginning of 2014 with publication of the sixth full genome of an individual who was not an anatomically modern human (Prüfer, K. and 44 others 2014. The complete genome sequence of a Neanderthal from the Altai Mountains. *Nature*, v. **505**, p. 43-49; DOI: 10.1038/nature12886). The newly sequenced material came from a toe bone found in the Denisova Cave in the Altai Mountains of southern Siberia; the same location made famous in 2010 by genetic evidence for unknown late hominins, the Denisovans . The bone occurred in the same layer of cave sediment, dated at 50.3 ka, which yielded the Denisovan finger bone, but from a lower sublayer. So there is no firm evidence that both groups cohabited the cave.

The genome reveals that the individual was female and related to the three, far-off Neanderthals from Croatia and another infant Neanderthal from the Caucasus, also analysed previously by Svante Pääbo's team at the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany (Note that the toe-bone team also includes co-workers from US, Chinese, Austrian, French and Russian institutions). The closest statistical link is to the Caucasian infant Neanderthal's DNA. Interestingly, it proved possible to demonstrate that the Siberian Neanderthal woman was from a population that was clearly inbred, her parents having been related at the level of half siblings. Her mtDNA shows that she shared a common ancestor with all 6 Neanderthals from whom mtDNA has been analysed.

Comparing genomes from the single Denisovan, the 5 Neanderthals and living humans from sub-Saharan Africans gives an estimated time of divergence of a population (550 to 765 ka) leading to anatomically modern humans from the progenitors of Neanderthals and the Denisovan. The Neanderthal-Denisovan split was roughly 380 ka ago. It was already known that non-African living humans contain genetic evidence for past interbreeding with Neanderthals and that some people in Asia, Australia, Melanesia and the Philippines had acquired genes from Denisovans. More refined comparisons now show these groups to have 3 to 6% Denisovan make-up, with Asians in general having a 0.2% share. Neanderthal to modern non-African gene flow is now estimated at between 1.5 and 2.1%, with Asians and Native Americans being at the high end. Neanderthals and Denisovans also interbred, but only at the level of about 0.5% inheritance. However, that genetic sharing involved DNA regions known to confer aspects of immunity and sperm function, which also made their way into living non-African humans.

Since the common ancestor of Neanderthals and Denisovans left Africa long before modern humans appeared on the scene it would be expected that living Africans' genomes would show the same level of similarity with both the now extinct groups, if all three originally shared a common ancestor. A surprising outcome from comparison of Neanderthal and Denisovan genomes with those of living sub-Saharan Africans is that there is a significant bias towards Neanderthal rather than Denisovan comparability. There are three possibilities for this bias. After the Neanderthal-Denisovan split the former group may have continued to interbreed with the group that led to modern Africans (and indeed to modern non-Africans): that would require Neanderthal genetics to have originated in Africa before

they migrated to Eurasia. Secondly, the gene flow could have been from the ancestors of modern humans to Neanderthal progenitors, making descendant Neanderthals more like modern humans. Prüfer *et al*. suggest that the evidence is less supportive of both and weighs towards a third possibility; that the Denisovans interbred with an unknown contemporary hominin, whose genetic make-up was yet more different from that of all three known groups of the late Pleistocene and therefore their common ancestor. This may have been *Homo antecessor* or possibly *H. erectus* who survived until as late as 20 ka in SE Asia.



Family tree of the four groups of early humans living in Eurasia 50,000 years ago and the gene flow between the groups due to interbreeding. (Credit: Prüfer et al. 2013)

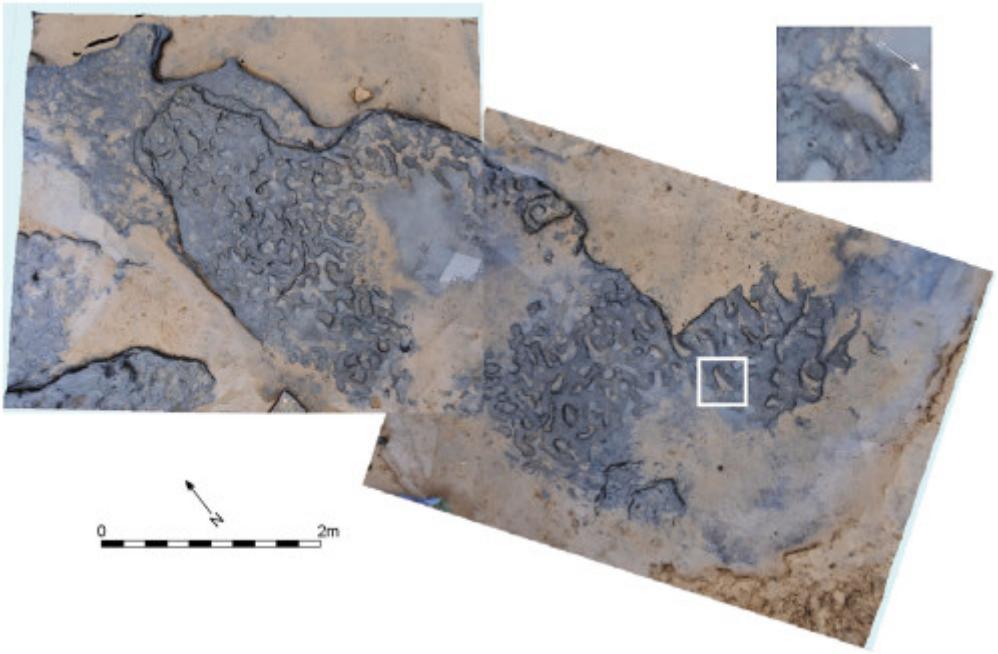
As other commentators on the paper (Birney, E. & Pritchard J.K. 2013. Four makes a party. *Nature*, v. **505**, p. 32-34; DOI: 10.1038/nature12847) have observed, '…Eurasia during the late Pleistocene was an interesting place to be a hominin, with individuals of at least four quite diverged groups living, meeting and occasionally having sex.' All this arises quite convincingly from the genetics of only 7 ancient individuals, to show that it may no longer be appropriate to consider human evolution as a tree or a bush linking permanently separated species. Either it is the history of a single, polymorphic species – remains of 1.7 Ma old *Homo erectus georgicus* show some evidence of such polymorphism – or a better metaphor for human development is an interwoven basket or twine. Rumour has it that attempts are being made to sequence an *H. antecessor* dated at 900 ka from Gran Dolina Cave in the Atapuerca Mountains in Northern Spain: as they say, 'Watch this space'!

Traces of the most ancient Britons (*February 2014*)

Perhaps the most evocative traces of our ancestors are their footprints preserved in once soft muds or silts, none more so than the 3.6 Ma old hominin trackway at Laetoli in Tanzania, discovered by Mary Leakey and colleagues in 1978. Such records of living beings' activities are by no means vanishingly rare. In 2003 footprints of Neanderthal children emerged in volcanic ash that had formed on the slopes of an Italian volcano. The fact that the tracks zig-zagged and included handprints seemed to suggest that the children were playing on a tempting slope of soft sediment, much as they do today (see *The first volcanologists?* March 2003 and *Walking with the ancestors* May 2009). The muddy

sediments of the Severn and Mersey estuaries in England yield younger footprints of anatomically modern humans of all sizes every time tidal flows rip up the sedimentary layers. Now similar examples have been unearthed from 1.0 to 0.78 Ma old Pleistocene interglacial sediments at a coastal site in Norfolk, England, in which stone tools had been found in 2010 (see *Earlier colonisers of northern Europe* September 2010.

Coastal exposure of Pleistocene laminated sediments at Happisburgh; the top surface exposes the hominin trackway (Credit: Ashton *et al*. 2014)



View from above of the well-trodden trackway at Happisburgh, with an enlarged example of one of the foot prints (credit: Ashton et al. 2014 PLoS1)

A team funded by the Pathways to Ancient Britain Project, involving scientists from a consortium of British museums and universities, rapidly conserved a 12 m^2 surface of

laminated sediments fortuitously exposed on the foreshore at Happisburgh (pronounced 'Haze-burra') by winter storms. It was covered in footprints (Ashton, N. and 11 others 2014. Hominin Footprints from Early Pleistocene Deposits at Happisburgh, UK. *PLoS ONE* v. **9**: e88329; DOI: 10.1371/journal.pone.0088329). Analysis of the prints suggested a band of individuals who had tramped southwards across mudflats at the edge of an estuary. They were possibly members of an early human species (*Homo antecessor*), skeletal remains of whom are known from northern Spain. The Happisburgh individuals were of mixed size, probably including adults and juveniles: three footprint sets suggested 1.6 to 1.73 m stature and nine who stood at less than 1.4 m.

From pollen samples, East Anglia during the interglacial had a cool climate with pine, spruce, birch and alder tree cover with patches of heath and grassland. That it had attracted early humans to travel so far north from the Mediterranean climate where skeletal remains are found, suggests that food resources were at least adequate. It is hard to imagine the band having been seasonal visitors from warmer climes further south. They must have been hardy, and from the stone tools we know they were well equipped and capable of killing sizeable prey animals, bones of which marked by clear cut marks being good evidence for their hunting skills.

Related articles: 800,000-Year-Old Human Footprints Discovered in UK (sci-news.com)

Improved dating sheds light on Neanderthals' demise (*August 2014*)

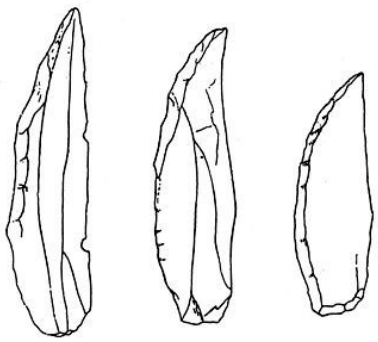
As I noted in December 2011 a refined method of radiocarbon dating that removes contamination by younger carbon has pushed back the oldest accessible ^{14}C dates. Indeed, materials previously dated using less sophisticated methods are found to be significantly older. This has led archaeologists to rethink several hypotheses (see *Disputes in the cavern* June 2012), none more so than those concerned with the relationship in Europe between anatomically modern humans (AMH) and Neanderthals, especially the extinction of the latter.

The team of geochronologists at Oxford University which pioneered accelerator mass spectrometry (AMS) of carbon isotopes, together with the many European archaeologists whose research has benefitted from it, have now published results from 40 sites across Europe that have yielded either Neanderthal remains or the tools they are thought to have fashioned (Higham, T. and 47 others. The timing and spatiotemporal patterning of Neanderthal disappearance. *Nature*, v. **512**, p. 306-309; DOI: 10.1038/nature13621). One such site is Gorham's Cave in the Rock of Gibraltar where earlier dating suggested that Neanderthals clung on in southern Iberia until about 25 ka. Another hypothesis concerns the so called Châtelperronian tool industry. Previous dating at the upper age limit of earlier radiocarbon methodology could not resolve whether or not the Châtelperronian culture preceded AMH colonisation of Europe; i.e. it could either have been a Neanderthal invention or copied from the new entrants. Most important is establishing when AMH first did set foot in previously Neanderthals' exclusive territory and for how long the two kinds of human cohabited Europe before the elder group met its end.

Reconstruction of Neanderthal life from the Neanderthal Museum

The new data do not quash the idea of Neanderthals eking out survival almost until the last glacial maximum in the southernmost Iberian Peninsula, since material from Gorham's Cave could not be dated. However, occupation levels at another site in southern Spain in which Neanderthal fossils occur and that had been dated at 33 ka turned out to be much older (46 ka). So it is now less likely that Neanderthals survived here any longer than they did elsewhere.

Neanderthal remains are generally associated with a tool kit known as the Mousterian that is not as sophisticated as that carried by AMH at the same time. Of the Mousterian sites that yielded AMS ages, the oldest (the Hyaena Cave in Devon, Britain) dates to almost 50 ka. The youngest has a 95% probability of being about 41 ka old. Of course, Neanderthals may have survived until later, but there is no age data to support that conjecture. The earliest known AMH remains in Europe are those associated with the so-called Uluzzian tool industry of the Italian peninsula. In southern Italy Mousterian tools are replaced by Uluzzian between about 44.8 and 44.0 ka, while Mousterian culture was sustained in northern Italy until between 41.7 to 40.5 ka.



Châtelperronian stone tools

Mousterian blade tool from France

Châtelperronian tools associated with Neanderthal remains occur in south-western France and the Pyrenees. The new AMS dating shows that the culture arose at about the same time (~45 ka) as the Uluzzian tool industry began in Italy and ended in those areas where it was used at about the same time (~41 ka) as did the more widespread Mousterian culture. So the question of whether Neanderthals copied stone shaping techniques from the earliest Uluzzian-making AMH more than 500 km to the east, or invented the methods themselves remains an open question. But does it matter as regards the cognitive abilities of Neanderthals? Copying methodology is part and parcel of the success and survival of succeeding AMH, but so too is the capacity to invent useful novelties from scratch. So, yes it does matter, for Neanderthals had sustained the Mousterian culture for tens to hundreds of thousand years with little change.

The upshot of these better data on timing is that AMH and Neanderthals co-existed in Europe for between 2.6 to 5.4 ka; as long as the time back from now to the Neolithic and early Bronze Age. Even allowing for low population density to make contacts only occasional, this is surely too long for systematic slaughter of Neanderthals by AMH. Yet it gives plenty of time for two-way transmission of cultural and symbolic activities, and even for genetic exchanges: assimilation as well as out-competition.

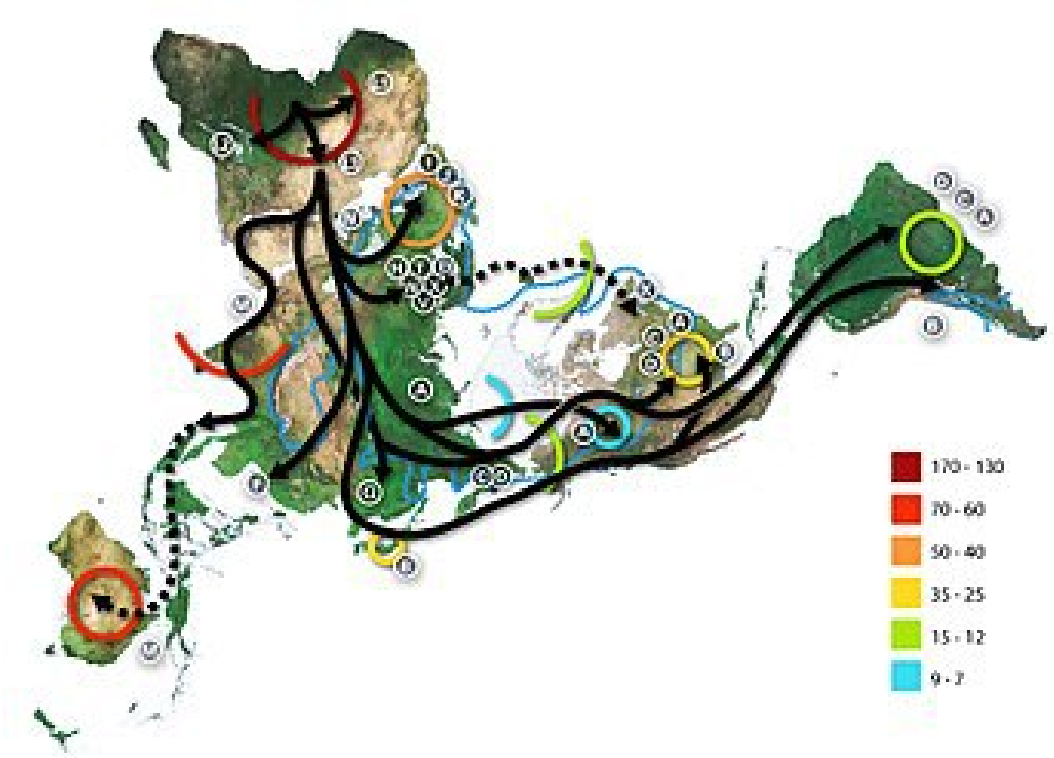
Incidentally, *Scientific American's* September 2014 issue is partly devoted to broader issues of human evolution (Wong, K. (editor) The Human Saga. *Scientific American*, v. **311**(3), p. 20-75) with a focus on new developments. These cover: a revised time line; the emerging complexity of hominin evolutio by veteran palaeoanthropologist Bernard Wood.; the influence of climate change; by Peter de Menocal; cultural evolution in the broad hominin context by Ian Tattersall; a discussion of hominin mating arrangements by Blake Edgar; two contributions on cooperation versus competition among hominins by Frans de Wall and Gregory Stix; two articles on recent biological and future cultural evolution by John Hawks and Sherry Turkle (interview).

Related articles: Neanderthals Coexisted with Humans for More Than 5,000 Years (sci-news.com)

Did Out of Africa begin earlier? (*August 2014*)

It is widely thought that anatomically modern humans (AMH) began to diffuse out of Africa during the climatic cooling that followed the last interglacial episode. Periods of build-up of

ice sheets, or stadials, also saw falls in sea level, which would have left shallow seas dry and easily crossed. The weight of evidence seems to point towards the narrowing of the Red Sea at the Straits of Bab el Mandab between modern Eritrea and the Yemen. Because the Red Sea spreading axis goes onshore through the Afar region of Ethiopia further north, the Straits today are shallow. Between about 70 and 60 ka, during a major stadial, much of the Bab el Mandab would have been dry. Dating of the earliest AMH remains in Asia and Australasia seems to suggest that the move out of Africa probably began around that time. But, of course, that presupposes the AMH fossils being the oldest in existence, although some would claim that genetic evidence also supports a 70-60 ka migration. Yet, AMH human remains dated at around 100 ka have been found in the Middle East on a route that would also lead out of Africa, but for the major problem of crossing deserts of modern Syria and Iraq. The supposed desert barrier has led many to suggest that the earlier venture into the Levant met a dead end. Should AMH fossils older than 70 ka turn up in Eurasia or Australasia then a single migration becomes open to doubt.



Map of large human migrations based on variations in mitochondrial DNA in living humans (Numbers are millennia before present)

It appears that challenge to what has become palaeoanthropological orthodoxy has emerged (Bae, C.J. *et al*. 2014. Modern human teeth from Late Pleistocene Luna Cave (Guangxi, China). *Quaternary International*, v. **354**, p. 169-183; DOI: 10.1016/j.quaint.2014.06.051). Scientists from the US, China and Australia found two molar teeth within calcite flowstone in Lunadong ('dong' means 'cave'). That speleothem is amenable to uranium-series dating, and has yielded ages between 70 and 127 ka. That antiquity does open up the possibility of earlier migration, perhaps during the interglacial that ended at about 115 ka when sea levels would have stood about as high as it does nowadays (in fact it was only after about 80 ka that it stood low enough to make a move across the Bab el Mandab plausible). If that were the case, the migration route would have

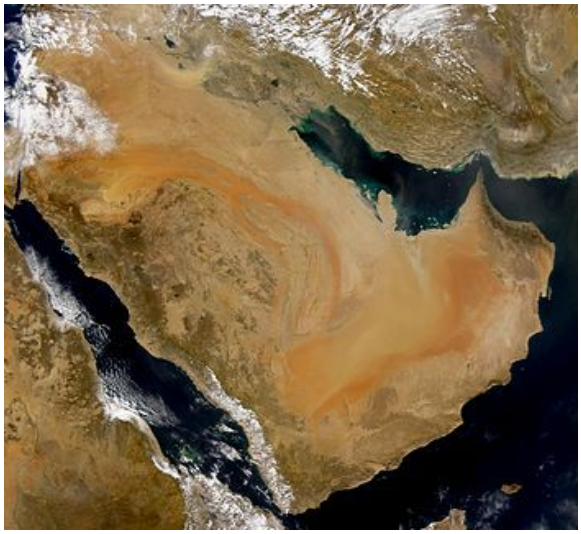
more likely been through the Middle East, perhaps along the Jordan valley and thence to the east. Had there been greater rainfall over what is now desert then there would have been no insurmountable barrier to colonisation of Asia.

These teeth are not the only evidence for earlier entry of AMH into east Asia; a date of 66 ka for a modern human toe bone was recently reported from the Philippines. Yet many experts remain unconvinced by teeth alone, especially from east Asia where earlier humans had evolved since first colonisation as early as 1.8 Ma ago. There are other pre-70 ka east Asian bones with more convincing AMH provenance, however.

There is another approach to the issue of earlier Out of Africa migration; one resting on theoretical modelling of the observed genetic and morphological variation among living Eurasians, especially the decreasing diversity proceeding eastwards (Reyes-Centeno, H. *et al*. 2014. Genomic and cranial phenotype data support multiple modern human dispersals from Africa and a southern route into Asia. *Proceedings of the National Academy of Sciences*, v. **111**, p. 7248-7253. doi: 10.1073/pnas.1323666111). The authors, from Germany, Italy and France, challenge the single-exit hypothesis based on genetic data, suggesting that those data are also commensurate with several Out of Africa dispersals beginning as early as 130 ka. They favour the Bab el Mandab exit point and migration around Eurasia at that time when sea-level was extremely low during a glacial maximum. They hint at the ancestors of living native Australians and Melanesians being among those first to leave Africa, other Asian and European populations having dispersed from a later wave.

Related article: "Out-of-Africa" is morphing into "Out-of Africarabia" as genetic and archaeological time-lines converge (6000generations.wordpress.com)

Arabia : staging post for human migrations? (*September 2014*)



The Arabian Peninsula from the SeaWIFS satellite (credit: Wikipedia)

From time to time between 130 and 75 ka fully modern humans entered the Levant from Africa, which is backed up by actual fossils. But up to about 2010 most palaeoanthropologists believed that they moved no further, because of the growth of surrounding deserts, and probably did not return to the Middle East until around 45 ka. The

consensus for the decisive move out of Africa to Eurasia centred on crossings of the Straits of Bab el Mandab at the entrance to the Red Sea, when sea level fell to a level that would have allowed a crossing by rafting over narrow seaways. The most likely time for such n excursion was during a brief cool/dry episode around 67 ka that coincided with an 80 m fall in global sea level: the largest since the previous glacial maximum (see Evidence for early journeys from Africa to Asia January 2010).

In 2011 a site in the United Arab Emirates was reported to have yielded 'East African-looking' Middle Palaeolithic tools in sediment layers dated at 125, 95 and 40 ka led some to speculate that there must have been an eastward move from the Levant by anatomically modern humans (see Human migration – latest news March 2011). That view stemmed from the fact that the earliest date was during the last interglacial when sea level would have been as high as it is today, and around 95 ka it would have been little different. That report coincided with others about freshwater springs having emanated from uplifted reefs around the edges of the Arabian Peninsula during the last interglacial, and the existence of substantial lakes deep within the subcontinent around that time (see Water sources and early migration from Africa November 2011). Substantial funding followed such exciting news and results of new research are just beginning to emerge (Lawler, A. 2014. In search of Green Arabia. *Science*, v. **345**, p. 994-997; DOI: 10.1126/science.345.6200.994).

Pleistocene palaeochannels of the Arabian Peninsula

A team led by Michael Petraglia of the University of Oxford has used field surveys and remote sensing to reveal a great many, now-vanished lakes across the Arabian Peninsula, including many in the fearsome Rub al Khali or Empty Quarter. They are linked by an extensive, partly sand-hidden network of palaeochannels, which include several of the major wadis; a system that once drained towards the Persian Gulf. As well as abundant freshwater molluscs and other invertebrates, former lakeshore sediments are littered with

huge numbers of stone tools, also with East African affinities (Scerri, E.M.L. *et al*. 2014. Unexpected technological heterogeneity in northern Arabia indicates complex Late Pleistocene demography at the gateway to Asia. *Journal of Human Evolution*, v. **75**, p. 125-142; DOI: 10.1016/j.jhevol.2014.07.002). Using optically stimulated luminescence dating, which shows how long stone objects have been buried, the British team has found tools dating back as long as 211 ka, with a cluster of dates between 90 to 74 ka. Modern humans, Neanderthals and even Denisovans may have made these tools; only associated fossil remains will tell. Yet it is already clear that for lengthy periods – perhaps of a few hundred or thousand years – the hyper-arid interior of Arabia was decidedly habitable. It may have been a thriving outpost of emigrants from Africa, whose abandonment as climate shifted to extreme dryness as the last interglacial gave way to Ice Age conditions, could well have been the source of the great migration that colonised the rest of the habitable world. Petraglia's team has already courted controversy with their claim for anatomically modern humans' tools in South Indian volcanic ash beds that date to the Toba eruption around 74 ka: considerably earlier than the more widely accepted post-65 ka dates of human eastward migration.

Related articles: Stone tools discovered in Arabia force archaeologists to rethink human history (Ian Sample, The Guardian); Can we retire the 60,000-year old coastal Out of Africa? (dienekes.blogspot.com)

'Earliest' figurative art now spans Eurasia

Posted on October 10, 2014 by Steve Drury | Leave a comment

The first generally recognised piece of artwork is abstract in the extreme: a worked piece of hematite with a complex linear pattern etched into it. It comes from Blombos Cave in South Africa, together with similarly engraved bone, shell ornaments and advances in stone tool kits. Dated at 100 ka, the Blombos culture is regarded by many palaeoanthropologists as the start of the 'First Human Revolution' (see *Snippets on human evolution* November 2011). Yet most believe that such a massive cultural shift only properly manifested itself around 40 ka in Europe shortly after its colonisation by anatomically modern humans. It was then that lifelike pictures of animals began to appear on the walls of caves, such as those discovered in Chauvet Cave in France and radiocarbon dated to between 35.5 to 38.8 ka.

Drawing of horses in the Chauvet cave

Such a Eurocentric view is based on the lack of evidence for precedent art of this kind from elsewhere. The adage that 'absence of evidence is not evidence of absence' - attributed to Carl Sagan - recently popped up with sophisticated dating of cave art in the Indonesian island of Sulawesi. The cave-riddled limestones of southern Sulawesi have long been known for artwork on the roofs of caves and in some of their darker recesses, including sketches of local animals, humans and a great many stencils made by blowing a spray of pigment over a hand placed on a rock face. The pictures were thought to be relatively recent.

Painting of a dwarf water buffalo and stencils of human hands from a cave in SW Sulawesi (credit: Aubert *et al*. 2014)

A joint Australian-Indonesian group of archaeologists used a specialist technique to date them (Aubert, M. and 9 others 2014. Pleistocene cave art from Sulawesi, Indonesia. *Nature*, v. **514**, p. 223-227; DOI: 10.1038/nature13422. See also Roebroeks, W. 2014. Art on the move. *Nature (News & Views)*, v. **514**, p. 170-171; DOI: 10.1038/514170a). Like many paintings in limestone caves, with time they become coated with calcite film deposited from water flowing over the rock surface, known as flowstone or speleothem. It is possible to date the film layers using the uranium-series method to derive a maximum age for the encased pigment from speleothem beneath it and a minimum age from the layer immediately overlaying it. One of the hand stencils proved to be the oldest found anywhere, with a minimum age of 39.9 ka, while sketches of animals ranged from 35.4 to 35.7 ka. To see more images and view an interactive video about the Sulawesi finds click here.

The discovery by Maxime Auberts and his colleagues has set the cat among the pigeons as regards the origin of visual art. The paintings' roughly coincide in age with the earliest in Europe, which raises three possibilities: the artistic muse struck simultaneously with people widely separated since their ancestors' emergence from Africa; somehow the skills were quickly carried a third of the way around the world from one place to the other; the original migrants from Africa took artistic ability of this kind with them to Eurasia, perhaps as early as 125 ka ago (see *Arabia : staging post for human migrations?* Above).

Three points need to be considered: whether in Europe or eastern Indonesia, cave art is preserved either on the roofs or in the deep recesses of caves, where it is more likely to survive then in more exposed sites; preservation by speleothem enhances longevity and the oldest works are in limestone caves; many more archaeologists have researched caves in

Europe than in the far larger areas of Asia and Africa. A view worth considering is that art may have begun outdoors, in a well-lit site on whatever 'canvas' presented itself. The artists' choice of cave walls in Europe and Indonesia may have resulted from the need for shelter from rain and/or cold, whereas much of Africa and Australia poses little need for 'interior design', or it may have been associated with rituals of few powerful shamans. Besides, what if art began on the most easily available canvas of all – human skin! My guess is that the record will widen in space and deepen in time.

Human evolution news (*October 2014*)

Since discovery of its fossilised remains in Liang Bua cave on the Indonesian island of Flores was discovered in 2004 the diminutive *Homo floresienesis*, dubbed the 'hobbit' by the media, has remained a popular news item each time controversies surrounding it have flared. To mark the tenth anniversary of its publication of a paper describing the remains *Nature* has summarised the recollections of many of those involved in trying to understand the significance of *H. floresiensis* (Callaway, E. 2014. Tales of the hobbit. *Nature*, v. **514**, p. 422-426; DOI: 10.1038/nature.2016.19651). Two main schools of thought continue in dispute, one holding that it is anatomically so different from anatomically modern humans and earlier members of the genus *Homo* that it constitutes a new species, despite its youngest member dating back only 18 ka, the other that it is *H. sapiens,* its tiny size having resulted from some kind of genetic disorder, such as microcephaly or Down's syndrome. There have been so many attempts to expunge the idea of such an odd fossil cohabiting an island with fully modern humans yet being a different and perhaps extremely archaic species that such an outlook itself seems somewhat pathological.

Replica of the *Homo floresiensis* skull from Liang Bua cave, Flores, Indonesia

The evidence presented to force *H. floresiensis* into a deformed human mould has never been convincing, and the best way of combating that view is to document from a 'non-combatant 'standpoint the many ways in which its anatomy differs from ours and how it might have arisen; a job to which Chris Stringer of the Museum of Natural History in London is amply qualified (Stringer, S. 2014. Small remains still pose big problems. *Nature*, v. **514**, p. 427-429; DOI: 10.1038/514427a). He, like the original discoverers, feels this is a case of evolution of small stature due to a limited population being isolated for a long time on a relatively small island, which is just what happened to elephants that colonised Flores to become the pigmy *Stegodon* that *H. floresiensis* seemingly hunted. These tiny Flores

dwellers (adults were about 1 m tall) used fire and made tools, similar ones dating as far back as ~1 Ma. Stringer mentions the possibility of first human colonisation about that time by Asian *H. erectus* but also the view that if it happened once there may have been several waves of immigration to Flores. The unusual 'hobbit' anatomy is not restricted to tiny size and a small skull and brain cavity (400 cm^3), but includes odd hips, wrist bones, shoulder joint and collar bone. In fact the remains bear as much or more resemblance to australopithecines like 'Lucy' (3.2 Ma) than to other members of our genus, even *H. erectus* that has been proposed as its possible ancestor. Could they be far-travelled descendants of the 1.8 Ma old *H. georgicus* from Dmanisi in Georgia? More fossils clearly need to be found, and Stringer raises the possibility of the search being widened to other islands east of Java, such as Sulawesi, the Philippines and Timor. He hints that in such a tectonically active region tsunamis may have led to animals and humans saving themselves and then being current dispersed on rafts of broken vegetation, rather like some survivors of the 2004 Indian Ocean tsunami who ended up 150 miles from their homes by such a means.

Another story that is set to 'run and run' is that of 'alien' DNA in the human genome and productive relations between early out-of-Africa migrants with Neanderthals, Denisovans and perhaps yet a mysterious, earlier human species. The oldest (45 ka) anatomically modern human genome sequence so far charted is from a leg bone found by a mammoth-ivory prospector in Siberian permafrost (Fu, Q. and 27 others 2014. Genome sequence of a 45,000-year-old modern human from western Siberia. *Nature*, v. **514**, p. 445-449p; DOI: 10.1038/nature13810). Like a great many living non-Africans this individual carried about 2% Neanderthal DNA, but unlike living people the 45 ka genome has it in significantly longer segments. That allowed the authors to re-estimate the timing of the genetic flow from Neanderthals into the individual's ancestors. Previous estimates from living DNA that was between 37-86 ka, but this closer data suggests that it happened between 7 to 13 ka before the date of the fossil femur, i.e. narrowing it down to between 52 and 58 ka closer to the widely suggested time of African exodus around 60 ka (but see *Arabia : staging post for human migrations?* above)

More on human evolution here and here

Art from half a million years ago (*December 2014*)

Eugene Dubois, an anatomist at the University of Amsterdam in the late 19th century, became enthralled by an idea that humans had evolved in what is now Indonesia, contrary to Charles Darwin's suggestion of an African origin. Dubois took the extraordinary step of joining the Dutch army and scrounging a posting to the Dutch East Indies to facilitate his search for a 'missing link', accompanied by his wife and newborn daughter. After a four-year quest, in 1891 he discovered the upper cranium and brow of a being that was obviously related to us, but also quite distinct as regards its beetling brow ridges. *Pithecanthropus erectus* (now *Homo erectus*) raised a storm of controversy, sadly only resolved in Dubois's favour after his death in 1940. Yet, as well as mounting the first deliberate search for human ancestors, Dubois collected everything he could from the sediments at Trinil, Java, so in a sense he was also an early palaeoecologist. The collection gathered dust in Leiden for the best part of a century, until archaeologist Josephine Joordens of the University of Leiden took on the task of reviewing its contents in 2007 (Joordens, J.C.A. and 20 others 2014.

Homo erectus at Trinil on Java used shells for tool production and engraving. *Nature*, v. **518**, p. 228-231; DOI: 10.1038/nature13962).

Progressively enlarged views of freshwater clam from Eugene Dubois's collection from Trinil, showing clear evidence of deliberate engraving. (credit: Joordens et al., 2014 in Nature; photos by Wim Lustenhouwer, VU University Amsterdam)

Homo erectus clearly had a taste for freshwater clams and lots of their shells figure in the Trinil collection: all are of similar large size rather than showing a wide variation according to age, suggesting a shell midden rather than a natural assemblage. A piece of serendipity revealed what may prove to be the anthropological find of the year. High-quality photos of the shells taken by a visiting mollusc specialist showed up evidence that one of them had been meticulously engraved. Its surface had a near-perfectly geometric, zig-zag pattern deeply gouged by someone with a steady hand, who probably used an associated shark's tooth as a scribing tool. Since the molluscs in life bear a dark, chitinous veneer the etching would have been more striking when freshly made. Another of these sturdy shells also show signs of having had its edge sharpened, suggesting that they were used for tools such as scrapers or graters.

The stratigraphy at Trinil suggested that the engraved shell and tools were coeval with *Homo erectus*, but that needed proof. Using sediment grains trapped in the shells and a combination of $^{40}Ar/^{39}Ar$ and thermoluminescence dating, the team have shown that they and the human fossils from Trinil date to between 430 and 540 thousand years ago: at least 350 ka older than the very similar engravings made by an anatomically modern human on ochre that was found at Blombos Cave in South Africa. The next-oldest putative artwork is the controversial 'Venus' found at Berekhat Ram on the Israel-Syria border, dated between 250 and 280 ka.

Engraved ochre from Blombos Cave, South Africa. (credit: Chris Henshilwood)

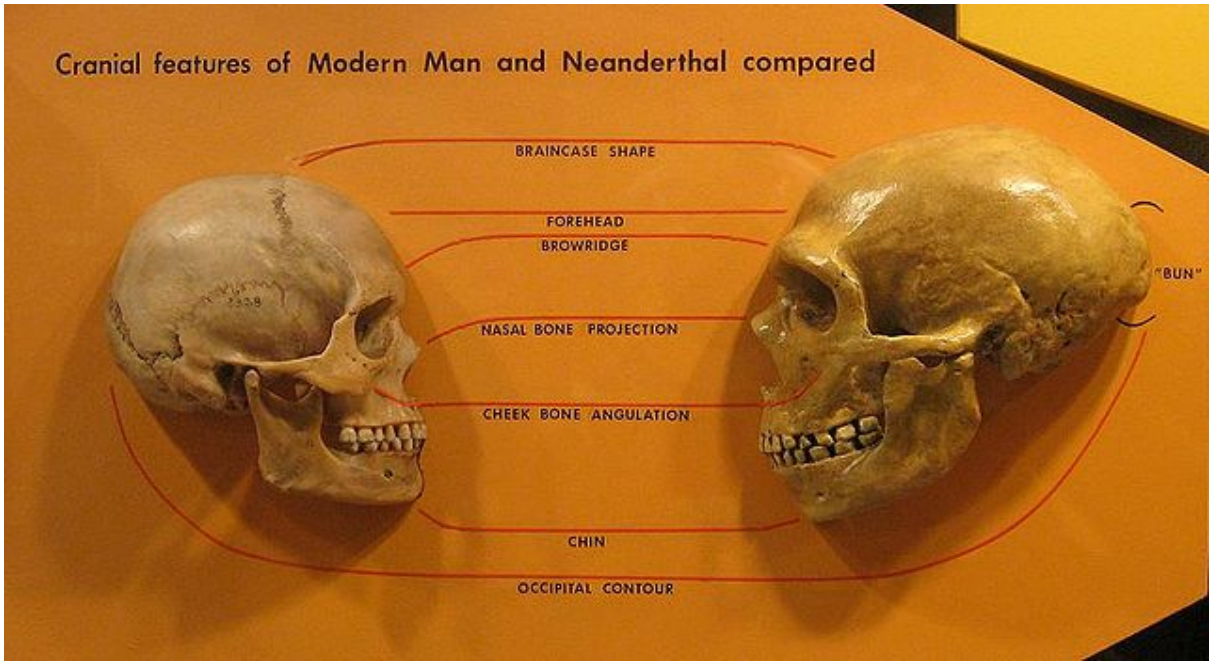
Probably the majority of palaeoanthropologists have dismissed humans other than *H. sapiens* as being cognitively incapable of either abstract or figurative art. The general view is that the mental capacity to create art or design began with the creation of the Blombos engraving, was restricted to anatomically modern humans and only exploded in Europe after they had migrated there by about 40 ka. A few argue that portable art, such as the Trinil and Blombos engravings, is bound by its very nature to be rare and easily overlooked. Whether having some use – counting? – merely being the making of an idle 'doodle' or expressing some unknowable ritual significance, the Trinil etching is a result of creativity and controlled skill that could only be the product of the *H. erectus* mind. Moreover, the very close comparison with the 0.35 Ma younger Blombos engraving suggests the product of a consciousness little different from that of our direct ancestors of 75 ka ago.

Related articles: Zigzags on a shell from Java are the oldest human engravings (smithsonianmag.com); Shell 'art' made 300,000 years before humans evolved (newscientist.com); Homo erectus made world's oldest doodle 500,000 years ago (nature.com)

Are modern humans 'domesticated'? (*December 2014*)

While animals, especially dogs, underwent domestication the deliberate or unconscious human choice of favoured physiological and behavioural traits produced distinct differences between the ancestral species and the 'breeds' with which we are now familiar. In general domestication has resulted in dogs with reduced jaws and flatter faces, lower aggression, especially in the case of males, and reduced stressfulness in the company of humans and other tame dogs compared with their wolf ancestors. It is widely accepted that cats have 'tamed themselves' through the adoption of lifestyles associated with the benefits of close association with human communities, which have resulted in similar adaptations to those in more deliberately domesticated dogs. It is beginning to dawn on anthropologists that human social evolution may unwittingly have affected the course of our own evolution. Tighter social bonding among growing sizes of communities as brain capacity increased and the behavioural and cognitive attributes needed for that have been summarised recently by a group associated with the Social Brain hypothesis of Robin Dunbar of Oxford University, UK (Gamble, C., Gowlett, J. & Dunbar, R.I.M. 2014. *Thinking Big: How the Evolution of Social Life Shaped the Human Mind*. **ISBN-13:** 978-0500051801;Thames and Hudson: London).

It was Charles Darwin who first speculated that 'Man in many respects may be compared with those animals which have long been domesticated'. But to what extent does the hominin fossil record support such a view? Collaborators from Duke University and the University of Iowa, USA, have set out to analyse physiological changes over the last 200 ka that may be explained in this way (Cieri, R.L. *et al*. 2014. Craniofacial feminization, social tolerance and the origins of behavioural modernity. *Current Anthropology*, v. **55**, p. 419-443; DOI: 10.1086/677209). Includes discussion and responses). They used the degree of projection of brow ridges, facial shape and cranial volume from 3 groups of *Homo sapiens* remains: skulls older than 80 ka (13 specimens); spanning 38 to 80 ka (41) and from recent humans (1367). They found that brow ridges shrank significantly over the last 80 thousand years, faces shortened and cranial capacity decreased, especially among males. This resulted in a convergence in appearance between males and females, which the authors attributed to general lowering of testosterone and stress hormone levels through selection for greater social tolerance: akin to similar physiognomic changes in domesticated dogs which DNA analyses have shown to be been linked with modification of genes associated with aggression regulation. The finding among dogs suggests that their domestication is accomplished by slower development; i.e. young animals are naturally less fearful and have a greater tendency to taming. This delayed development from foetus to adulthood, with retention in mature individuals of juvenile characteristics, is known as neoteny, and affects all manner of adult characteristics, including coloration, snout length and the adrenal glands: as adult dogs now more resemble wolf pups, so human adults are more like young chimps than elders. At a conference where Cieri *et al*.'s results were presented, it was observed that hunter gatherer bands are intolerant, to the point of capital punishment, of wife stealers, murderers and seriously dishonest individuals, whereas such reactions fall off significantly among members of larger social groups involved in agriculture and urban life. Such modern behavioural patterns tally with brow ridge, face length and cranial capacity, perhaps linked with selection for personalities more attuned to cooperation.



Comparison of Neanderthal and Modern human skulls from the Cleveland Museum of Natural History (credit: Wikipedia)

Although earlier human species, such as *H. neanderthalensis, heidelbergensis* and *erectus* had significantly different skull anatomy, each had prominent brow ridges that, on this account, may signify both greater exposure to testosterone and less social tolerance, and smaller group sizes. But, so far, analysis of the Neanderthal genome has not led to publication of any comments about genes related to testosterone or stress hormones. However, a clear strand of discussion is developing around evidence rather than mere speculation about psychological/cognitive aspects of human evolution that challenges, through a dialectic between social and biological relationships, the old-style 'what-you-see-is-what-there-was' (WYSWTW) archaeological dogma.

Related articles: Gibbons, A. 2014. How we tamed ourselves – and became modern. *Science*, v. **346**, p. 405-406; DOI: 10.1126/science.346.6208.405.